Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
1998 Biennial Regulatory Review --	)	
	)	ET Docket No. 98-42
Amendment of Part 18 of the	)	
Commission's Rules to Update	)	
Regulations For RF Lighting Devices	)	

To: The Commission

COMMENTS
OF
METRICOM, INC.

Metricom, Inc. ("Metricom"), by its attorneys, pursuant to § 1.415 of the Commission's rules, hereby submits these Comments in response to the Commission's Notice of Proposed Rule Making in the above-referenced proceeding [1] concerning amendment of the rules as they relate to RF lighting devices ("NPRM").[2] Metricom is keenly interested in this proposal because (a) the NPRM completely fails to recognize the significant Part 15, unlicensed, spread spectrum operations in the 2400-2483.5 MHz frequency band (the "2400 MHz Band"); and, (b) the microwave lighting devices operating in the 2400 MHz Band, with no radiated power limits within the defined band, could cause substantial interference to Part 15, unlicensed operations in

1. 63 Fed. Reg. 20362 (April 24, 1998).

2. Metricom is a member of the Part 15 Coalition and Metricom supports the Comments filed by the Coalition. These Comments are intended to supplement those of the Part 15 Coalition.

general, and to Metricom's newest generation product operating in this band, in particular. This interference problem is exacerbated by the fact that microwave lighting devices will have essentially unlimited duty cycles (*i.e.,* they will be operating continuously for all or part of each day), and they will be placed at elevated locations. While Metricom applauds and supports the Commission for encouraging the development and deployment of state of the art RF lighting technology, Metricom is concerned that the delicate balance established by the Commission to assure that the 2400 MHz Band can be shared may be placed in jeopardy. In order to preserve this delicate balance, the Commission must specify in-band radiation limits, in addition to out-of-band limits, for microwave lighting devices. If the Commission specifies out-of-band limits as proposed, the requisite shielding to meet Part 15 in-band limits should not be unreasonably difficult or expensive for microwave lighting manufacturers to implement.

I. BACKGROUND AND INTEREST

1. Metricom is a young, rapidly growing, wireless telecommunications company based in Silicon Valley. As a result of the Commission's encouragement, articulated in various Part 15 proceedings, Metricom has become a pioneer in the development of state-of-the-art, spread spectrum, unlicensed data communications systems operating pursuant to Part 15 of the Commission's rules. Although Metricom's commercial operations are currently in the 902-928 MHz band, the newest generation of Metricom's equipment, available commercially in later 1999, will use the 2400 MHz Band. Metricom has invested significant sums of money, time and energy to develop, manufacture and deploy sophisticated RF devices which operate on an unlicensed basis pursuant to Part 15 of the Commission's rules. The new generation of equipment will operate at a gross over-the-air transmission rate of up to 1 Mbps, and provide

user data rates of up to 128 kbps. Metricom's Ricochet[3] service is the fastest, most easily deployable, and least expensive campus and metropolitan area wireless data network available today. Metricom currently serves more than 22,000 subscribers.

2. Metricom was able to develop its system primarily because it was encouraged to operate a spread spectrum system in an unlicensed environment. Commercially successful operations in the unlicensed environment require the utilization of adaptive and intelligent RF transceivers. This is especially important because no one can predict the technology or applications which will be developed for the band. In spread spectrum systems, interference at the radio physical layer is mitigated and "worked through" by technologies applied at the link and routing layers of current Part 15 systems and by coding gain and additional signal processing. Thus, newer technologies deal very well with interference: both intrasystem and intersystem interference is expected by design engineers and is considered a normal part of operations. In fact, the introduction of spread spectrum is one of those newer technologies that helps reduce interference to and from other systems.

3. The problem arises, however, when a product or service is introduced into the band which is not compatible with existing sharing of the spectrum because it is transmitting or radiating so many more times the power than the Part 15 devices operating at 1 watt output power. Although Part 18 ISM microwave ovens are currently the largest factor in broadband interference generation at 2400 MHz, the microwave lighting systems pose a much greater interference threat because they are very broad band in nature and have *no radiated power limits*

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3. Ricochet is a registered trademark of Metricom.

within the defined bands. Furthermore, the duty cycle and location of the RF lighting devices are many times more likely to cause interference to Part 15 operations in the 2400 MHz Band than microwave ovens. Microwave ovens are located indoors and are only activated for short periods of time. The RF lighting devices will be located outdoors, at elevated locations, and will be radiating continuous RF energy for approximately 8 to 24 hours per day. Without any in-band radiated limits, these types of operations of RF lighting devices could significantly impact the numerous Part 15, 2400 MHz point-to-point links currently in use. Moreover, without any in-band radiated limits, the RF lighting devices could have a devastating impact on Metricom's Part 15, 2400 MHz omnidirectional operations.

II. IN BAND RF RADIATION FROM MICROWAVE LIGHTING DEVICES IS SUBSTANTIAL BUT ALLEVIATING THIS POTENTIAL SIGNIFICANT PROBLEM IS NOT DIFFICULT

4. In order to learn more about the microwave lighting devices which are the subject of the NPRM, Metricom performed some "real world" field testing on these devices in actual operation. On February 6, 1998, at approximately 8:45 p.m., Metricom's Director, Systems Engineering, went to the Department of Energy in Washington, D.C. and performed some testing. Using an HP 8590 Series spectrum analyzer with a 0 dB gain antenna located approximately 20 feet below the RF lighting device, it was determined that the microwave lighting device was emitting approximately 15 watts of radiated power. A print-out of this test from the spectrum analyzer is attached as Exhibit 1.

5. In-band RF emissions from microwave lighting devices are merely RF leakage. Limiting the RF leakage has no effect on the amount of power permitted to be used by the device. Accordingly, limiting in band emissions of such devices has no impact on the power

which such devices use; it merely requires the microwave lighting device to operate more efficiently. Moreover, because the microwave lighting industry is presently nascent, and because the Commission is proposing to put a limit on out-of-band emissions, the cost to manufacture and implement shielding to limit in-band RF emissions should be negligible.[4] This is a small price to pay in order to assure that the 2400 MHz Band can continue to be shared.

III. THE NPRM FAILS TO CONSIDER THE SIGNIFICANT USE OF THE 2400 MHz BAND BY PART 15 OPERATIONS

6. The NPRM, completely fails to consider operations in the 2400 MHz unlicensed bands. Based upon an informal study commissioned by Metricom in 1997,[5] it was estimated that approximately 20% of all revenues generated by the sale of spread spectrum RF products came from the 2400 MHz Band. For 1996, it was estimated that revenues for the sale of 2400 MHz spread spectrum products was approximately $240 million. Revenue projections for 2400 MHz products are anticipated to reach $2.5 billion by the end of 1998.[6] Significant migration to the 2400 MHz spread spectrum band has occurred to insure conformance with the IEEE 802.11 standard, to simplify international homologation (especially because the 902-928 MHz spread spectrum band conflicts with Europe's GSM digital cellular allocation) and to take advantage of

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4. Metricom agrees with the Part 15 Coalition that the out-of-band radiation limits proposed at ¶12 of the NPRM should also be applicable to the in-band radiation limits.

5. "Part 15 ISM Band Markets," Ira Brodsky, Datacomm Research Company, Wilmette, Il, March 24, 1997 (the "Datacomm Report").

6. *See First Report and Order, Allocation of Spectrum Below 5 GHz Transferred from Federal Government Use*, 10 FCC Rcd. 4769 at ¶ 33 (citations omitted).

greater available bandwidth.[7] As a result, the 2400 MHz band spread spectrum product revenues and operations are expected to continue to grow.

7. In a recent Decision considering whether to allocate the 2400 MHz band for uses incompatible with unlicensed operations, the Commission stated:

> Part 15 devices provide a variety of consumer and business oriented services that benefit individuals, commercial services, and private spectrum users, and they also have applications for public safety and medical needs. . . . [A]pplications of technologies implemented through Part 15 devices have the potential to benefit virtually every person and business in the nation, as well as to promote American competitiveness abroad. Considering the universal benefits provided by Part 15 equipment, the potential growth for new technologies in this area . . . we find that the public is best served by providing for the continued availability of this band for Part 15 equipment.[8]

At the very least, then, the Commission should issue a further NPRM seeking comment on the impact of the NPRM on Part 15 devices and operations in the 2400 MHz Band. Failure to do so could result in serious deficiencies in complying with the requirements of the Administrative Procedure Act.

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7. *See, also, Id.* at ¶ 30, indicating that since the Commission encouraged the development of spread spectrum unlicensed systems in the 2400 MHz Band, among others, the industry has responded with a wide variety of products which provide the kind of spectrum efficient uses, new technologies and open competitive markets that the Commission is trying to promote. It is further stated that since the 2400 MHz Band is increasingly available internationally for Part 15 type use, and it is likely that the IEEE 802 standard will be used internationally, it could undermine the nation's international competitiveness if the Commission adversely affects Part 15 use of the band.

8. *Id.* at ¶ 32.

IV. THE COMMISSION HAS AN OBLIGATION TO ACCOMMODATE SECONDARY USERS IN THE 2400 MHz BAND

8. The Commission has consistently recognized the need to balance the interests of various parties sharing unlicensed bands. Less than twelve months ago, the Commission held that it was appropriate to balance the interests of various parties sharing a Part 15 spread spectrum band (902-928 MHz) so as to limit the potential for harmful interference.[9] In its *Memorandum Opinion and Order* in the LMS proceeding, the Commission acknowledged that Part 15 operations in a particular band must accept interference from all other operations in the band, and reiterated that unlicensed Part 15 operations have no vested or recognizable right to continued use of any given frequency. The Commission went on to state, however, that:

> Nonetheless, the Commission recognized the concerns of Part 15 . . . interests with respect to their secondary status. Accordingly, in order to alleviate such concerns and to provide all operators in the band with a greater degree of certainty in configuring their systems, thereby promoting competitive use of the band, the Commission adopted . . . [specific] definition[s] of non-interference.[10]

The Commission thus concluded that effective, efficient sharing of the band with unlicensed operations does not equate to changing the status between allocations and uses within the band.

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9. *Memorandum, Opinion and Order, Amendment of Part 90 of the Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems*, 12 FCC Rcd 13942 (1997) at ¶ 32.

10. *Id.* It must also be noted that while § 15.5 provides that Part 15 devices must accept interference from Part 18, this does ***not*** mean that the Commission is unable to amend or modify Part 18 requirements.

Rather, the Commission chose to balance the equities and value of each use without undermining the established relationship between unlicensed services and other services sharing the band.

Given the recognized, extensive use of the 2400 MHz Band by unlicensed operations, the Commission must take those uses into consideration when promulgating rules for microwave lighting devices. As the Commission has stated:

> We believe that the public is benefitted more by allowing the greatest number of possible users of this band under Part 15 of the Rules rather than by restricting use to one type of application."[11]

V. THE COMMISSION SHOULD NOT ALLOW UNLIMITED IN-BAND RADIATED EMISSIONS BECAUSE IT MUST CONSIDER HUMAN EXPOSURE TO RF RADIATION FROM MICROWAVE LIGHTING DEVICES

9. While it is recognized that the Commission does not regulate RF exposure limits for ISM equipment,[12] this does not mean that the Commission can ignore RF exposure limits which have the potential to significantly adversely impact the public health. With no radiated power limits in the 2400 MHz Band, the proliferation of RF lighting devices there could have severe health implications. As these devices become more widely used, no doubt they will be used in places closer and closer to humans. As discussed below, RF exposure from existing microwave lighting devices exceeds that which is prescribed by the Food and Drug Administration (the "FDA") for human exposure to microwave oven radiation. With no radiated power limits within the band, the possible human exposure to RF radiation could be significant and adverse.

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11. *Allocation of Spectrum Below 5 GHz*, at ¶ 35.

12. *See, e.g., § 1.1307 of the rules.*

10. Because of the widespread use of microwave ovens in the 2400 MHz Band, a review of the FDA's RF exposure limits was undertaken. The Power Density Limits for microwave ovens found at 21 C.F.R. 1030.10(c)(1) provide that:

> Power Density Limit. The equivalent plane-wave power density existing in the proximity of the external oven surface shall not exceed 1 milliwatt per square centimeter at any point 5 centimeters or more from the external surface of the oven, measured prior to acquisition by a purchaser, and, thereafter, 5 milliwatts per square centimeter at any such point.[13]

Taking this regulation into consideration and comparing measurements made by Metricom at the Department of Energy where Fusion's microwave lighting device is employed, it was observed that the microwave lighting device was radiating 15 watts of power. Extrapolating from this data to convert it to the limits specified by the FDA demonstrates that human exposure to RF radiation from the microwave lighting device would be equal to 48 milliwatts per square centimeter at 5 centimeters from the external surface of the radiating device. Therefore, the RF exposure from the RF lighting device, from in-band RF radiation, is ***more than 9 times*** the allowable limits of the least stringent FDA standard. This clearly demonstrates that the RF exposure from the microwave lighting device far exceeds the allowable limits for human exposure to microwave ovens (which operate in the same frequency band) as specified by the FDA.

11. Because the RF exposure from the microwave lighting device exceeds the FDA's power density limits, it is clear that it would be good public policy for the Commission to either

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13. 21 C.F.R. § 1030.10(c)(1).

introduce some in-band radiated limits on microwave lighting, or refer this matter to the FDA for purposes of developing standards to assure that the public health is protected.

VI. CONCLUSION

For all of the foregoing reasons, the Commission should adopt in-band radiation limits, as well as out-of-band radiation limits, for RF lighting devices.

Respectfully submitted,

METRICOM, INC.

By: _____

Henry M. Rivera
Larry S. Solomon
SHOOK, HARDY & BACON LLP
1850 K Street, N.W.
Suite 900
Washington, D.C. 20036
Telephone: 202-452-1450

ITS ATTORNEYS

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EXHIBIT 1